SERVICE GUIDE
WITHSTANDING VOLTAGE TESTER

MODEL TOS8650

KIKUSUI

CONTROLLED DOCUMENT
KIKUSUI
TOS8650
WITHSTANDING VOLTAGE TESTE
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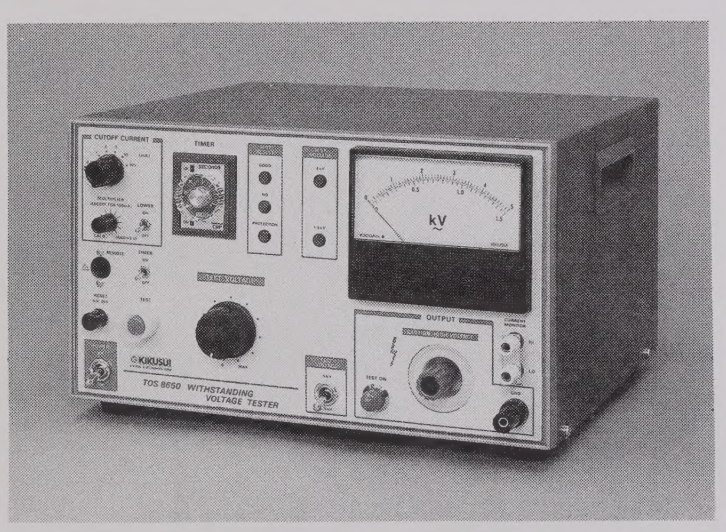
SERVICE GUIDE

WITHSTANDING VOLTAGE TESTER

TOS8650



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3-1175, SHINMARUKO-HIGASHI, NAKAHARA-KU KAWASAKI-CITY, JAPAN

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SECTION 1

SPECIFICATIONS

1. SPECIFICATIONS

Model		TOS8650
Test voltage	Applied voltage (AC)	0~1.5 / 0~5 kV
	Output	500 VA (5 kV, 100 mA), when operated on 100 V AC line. (Note 1)
	Waveform	AC line voltage waveform
	Voltage regulation (with 100 V AC line)	20 % or better
		(For change from maximum rated load to no load)
	Switching	Zero-turn-on switch (zero-start-switch) is used.
Current limiting		◦ A limiting resistor is inserted in the primary circuit of high voltage transformer. ◦ When cut-off current setting is 100 mA, current limiting is released unconditionally. When it is 0.5~10 mA, current limiting is selectable.
Output voltmeter	Scales	1.5 / 5 kV FS
	Class	JIS Class 1.5
	Accuracy	±3 % FS
	Response / graduation	Mean-value response / rms-value graduation
Judgement of test result (Shut-off of output by leak current detection)	Judgement system	◦ Window comparator system ◦ NG judgement when current larger than the set value is detected ◦ NG judgement when detected current is less than 1/10 of the set value ◦ When NG judgement is made, the output is cut out and an NG alarm is generated. ◦ If no abnormal state is found during the set period, the GOOD signal is generated.
	Reference value setting	0.5, 1, 2, 5, 10, or 100 mA
	Multiplier	◦ Each of the above setting values can be multiplied up to 2.5 times continuously variably, except the 100 mA range. ◦ The scales are non-calibrated.
	Accuracy of judgment (Note 2)	◦ With reference to high limit (set value): ±5 % ◦ With reference to low limit (1 / 10 of set value): ± (20 % +20 μA)
	Detection system	Absolute value of leakage current is integrated and compared with the reference value.

Model		TOS8650
Judgement of test result (Cont'd)	Calibration	Calibrated for rms value of sine of sine wave, using pure resistive load.
	No-load output voltage needed for detection (Note 3)	500 V when at 100 mA setting
Dimensions (Maximum dimensions)		350W×200H×300D mm (13.78W×7.87H×11.81D in.) 360W×220H×355D mm (14.17W×8.66H×13.98D in.)
Weight (Note 4)		Approx. 19 kg (42 1b)

Note 1: The period during which the Testers can be continuously operated with their maximum rated currents are as follows:

- TOS8650: Up to 30 minutes

Note 2: When a test is actually done, the current which flows through the stray capacitances of the output circuit and measuring leads also causes measuring errors. The overall judgement error is the sum of this current and the above-mentioned judgement accuracy.

Approximate values of such currents are shown in the following table. Note that, at high-sensitivity high-voltage test, the current which flows through the stray capacitances becomes larger than the low-limit judgement value and low-limit judgement may not be successfully made.

Output Voltage	1 kV	2 kV	3 kV	4 kV	5 kV
Main unit only (without measuring leads)	4 μA	8 μA	12 μA	16 μA	20 μA
When 300-mm-long leads are used being suspended in air	6 μA	12 μA	18 μA	24 μA	30 μA
When the accessory lead-wires (HTL-1.5W) are used	20 μA	40 μA	60 μA	80 μA	100 μA

Note 3: Due to the internal resistance of the output circuit, to make NG judgement with the output terminals shorted, a certain level of no-load output voltage is needed. The values of such voltages are shown in the preceding table.

Note 4: Approx. 4 kg increase when in line voltage modified.

Test voltage waveform:

When an AC voltage is applied to a capacitive load, the output voltage may become higher than that when in no load due to the capacitance component of the load. Especially when the load (specimen) is of a voltage-dependent capacitance type (such as ceramic capacitors), the voltage waveform may be distorted. When the test voltage is 1.5 kV, however, effects caused by a capacitance lower than 1000 pF is negligible.

Test time:

Timer setting time: 2~60 sec. (with timer OFF switch)

Remote control:

(1) The test / reset operation can be remote-controlled in the following cases:
- When the Remote Control Box (optional) is used.
- When the High Voltage Test Probe (optional) is used.
- When the instrument is controlled with a make-contact of a relay or a switch.
- When low-active control is made with logic elements. The input conditions of the Testers in this case are as follows:
  - HIGH level input voltage: 11~15 V
  - LOW level input voltage: 0~4 V
  - LOW level sweepout current: 2 mA or less

Note 5: The input terminals are pulled up to +15 V supply voltage by a resistor. If the input terminals are made open, the state is identical with that a HIGH level input is applied.

(2) The Tester can be set to the protected state (the state that TEST ON is disabled) by making open the protection input terminals which normally are shorted with a shorting bar.

Leak current monitor terminals:

When checking or calibrating the cutoff current, a milliammeter to monitor the current may be connected to these terminals.

Output signals:

The types of the output signals available and the conditions of their generation are as follows:

Name of signal	Conditions for signal generation	Type of signal
TEST signal	During the period the test is performed	Make-contact signal, lamp
GOOD signal	When GOOD judgement is made, 200 msec	Make-contact signal, lamp, buzzer
NG alarm	When NG judgement is made, continuous	Make-contact signal, lamp, buzzer

Note 6: (1) The rating of the contact signal are 100 V AC, 1 A, or 30 V DC, 1 A.
(2) Loudness of the buzzer sound is adjustable with a signal knob in common for both GOOD and NG signals.

Ambient conditions:

Temperature and humidity to meet specified performance:
5 to 35 °C (41 to 95 °F), 20 to 80 % RH
Operable temperature and humidity:
0 to 40 °C (32 to 104 °F), 20 to 80 % RH

Power supply:

Supply voltage range: 100 V ±10 %, 50 / 60 Hz AC
(These models can correspond to nominal voltages 110 V, 115 V, 120 V, 220 V, 230 V and 240 V respectively, subject to prior modification.)
Power consumption: 10 VA or less when no load (in the reset state) Approx. 600 VA when with rated load.
Insulation resistance: 30 MΩ or over, with 500 V DC
Withstanding voltage: 1000 V AC, 1 minute

Accessories:

- High Voltage Test Leadwires, HTL-1.5 W — 1 set
- Shorting Bar to Remote Protection Terminal — 1 (Installed on main unit)
- Shorting Bar for Current Monitor Terminals — 1 (Installed on main unit)
- "HIGH VOLTAGE DANGER" label — 1
- Instruction Manual — 1
- 5P DIN Plug (assembly type) — 1

SECTION 2

BLOCK DIAGRAM

2. BLOCK DIAGRAM

2.1 Block Diagram

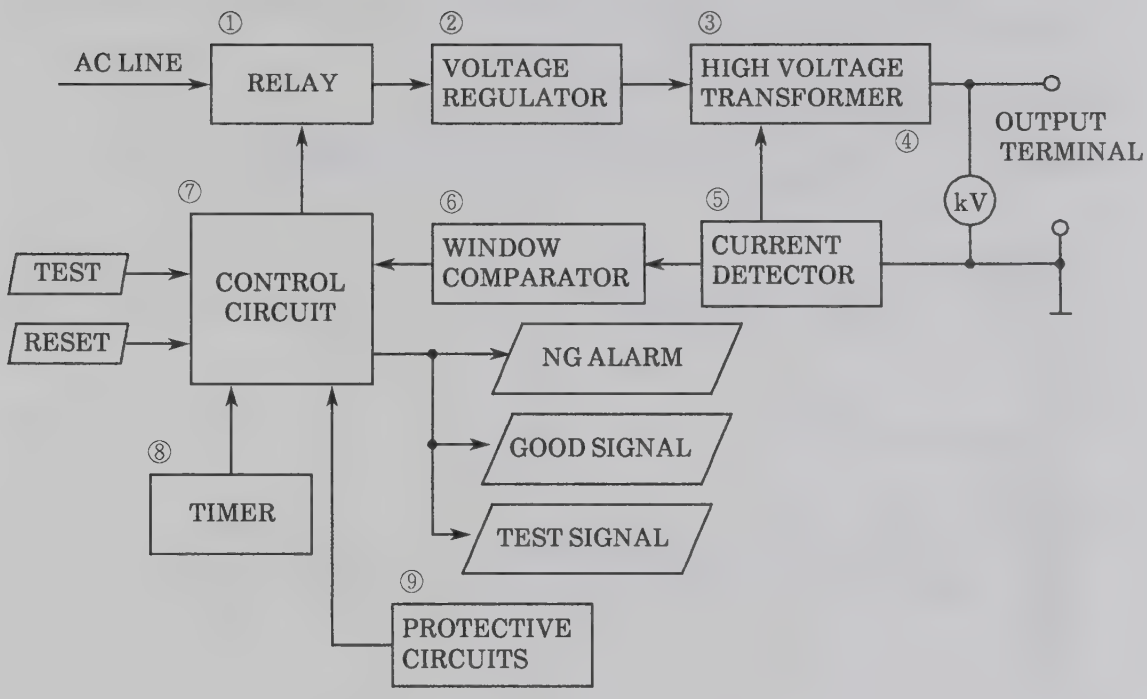

Fig. 2-1

2.2 Descriptions of Individual Circuits and Components

① Relay:

On-off controls the power applied to the voltage regulator for with-standing voltage test. A solid-state zero-turn-on type relay circuit is employed to minimize transient spike voltage caused when the Relay is turned on and off.

② Voltage regulator:

A slide transformer is used to control the output voltage.

③ High voltage transformer:

Boosts the voltage regulator output with a ratio of approximately 1:15 or 1:50 into a high output voltage of 0 to 1.5 kV or 0 to 5 kV. The rating is 5 kV, 100 mA, 500 VA, when the AC line voltage is 100 V.

④ Voltmeter:

Indicates the output voltage (the voltage of the output terminal).

⑤ Current detection circuit:

Consists of a full-wave-rectifier diode bridge circuit, current detecting resistors for respective ranges, and an integrating circuit.

⑥ Window comparator:

Consists of a reference voltage generator circuit, and a high and a low comparator circuit. Makes GO-NOGO judgment.

⑦ Control circuit:

Controls overall sequence operations of the instrument. Employs high-reliability logic circuits with CMOS IC.

⑧ Timer

To set the test time.

⑨ Protection circuit:

Various protective features are incorporated for the safety of test.

But be careful to operate. When the protection circuit has tripped, the output voltage is cut off.

SECTION 3

CALIBRATION AND ADJUSTMENT

3. CALIBRATION AND ADJUSTMENT

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3.1 Outline

This unit must be calibrated after it has been used for a certain period (periodic calibration).
The components used in the unit do not undergo any significant change in characteristics during the normal periodic calibration interval (one year). If the unit is not calibrated for long period, however, the total accumulated change in the characteristics of the various components may sometimes cause the characteristics of the unit to deviate from the standard.
When calibrating the unit, use correctly calibrated calibrators. Also, be careful of the supply voltage applied to the calibrators.
During calibration, maintain the supply voltage within the input power range and the frequency 50 Hz or 60 Hz. Keep the temperature within 25 °C ± 5 °C and the humidity within 60 % ± 10 %.

3.2 Preparations

3.2.1 Removing the cover

Remove the four screws on both sides and the four screws on top. Refer to Fig.3-1.

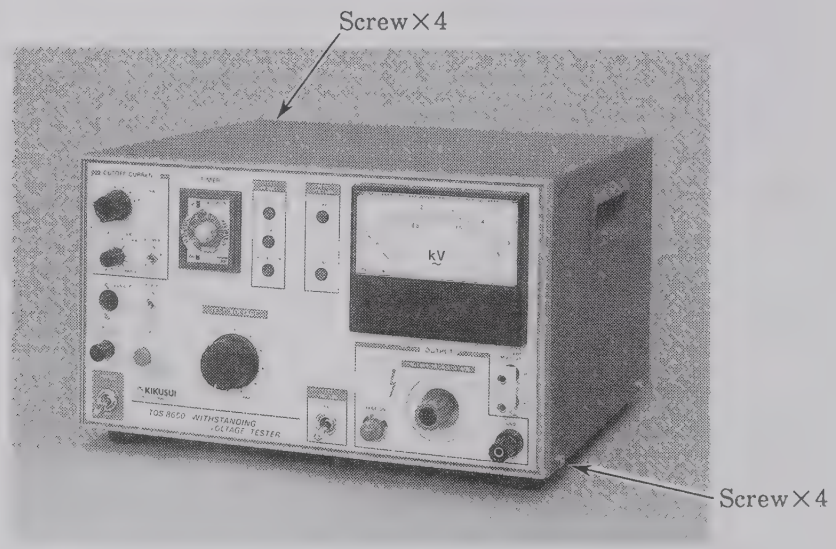

Fig. 3-1

3.2.2 Board layout

Table 3-1 Printed circuit board in the unit

Board No.	Board name	Remarks
A1	Main board	
A2	Signal output board	
A3	Display board	
A8650	AC HV detector board	

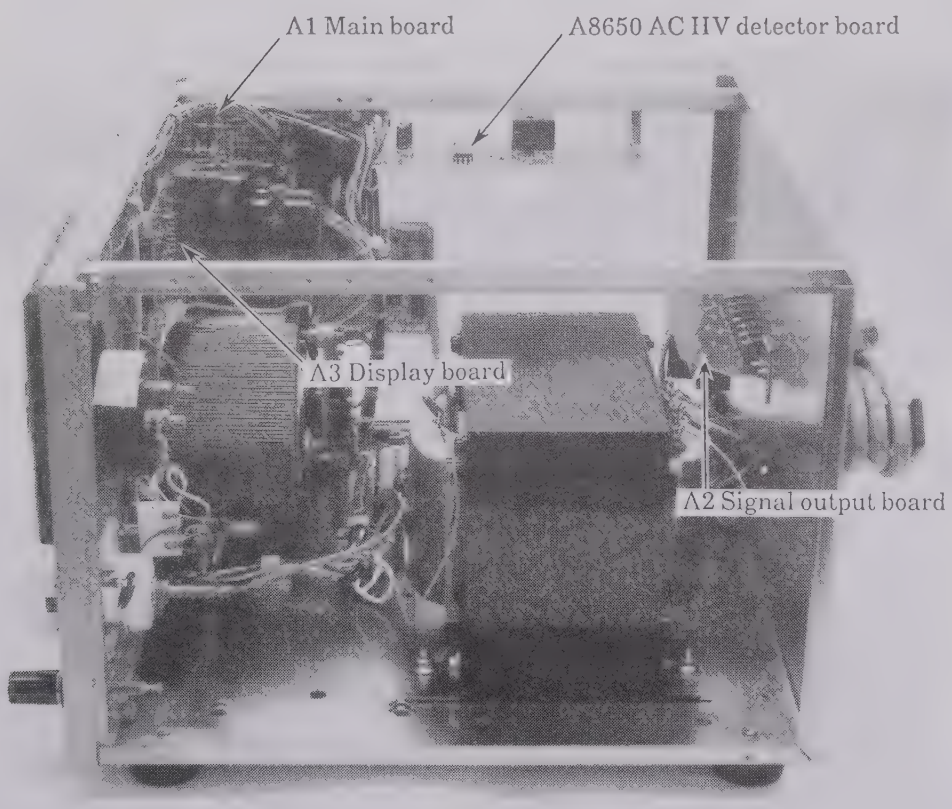

Fig. 3-2 Printed circuit board layout

3.3 Required Test Equipments List

Table 3-2

Test Equipment	Required Characteristics	Remarks
Calibrator for withstanding voltage tester	Kikusui TOS1200	
High voltage digital voltmeter	Measuring range ..... More than 5 kV AC Accuracy ..... Within ±1 % Resolution ..... 1 V or less	Kikusui 149-10A
Digital voltmeter	Measuring range ..... More than 100 V DC Accuracy ..... Within ±0.1 % Resolution ..... Less than 10 mV	Kikusui DME1400
Oscilloscope	Frequency range ..... DC to 20 MIz Input sensitivity ..... 5 mV to 5 V/DIV Sweep time ..... 0.5 s to 0.2 μs/DIV	Kikusui COS5020TM

3.4 Initial Setting

(1) Set the switches on the panel of the TOS8650 as follows.

POWER switch	OFF position
TEST VOLTAGE knob	Turn fully counterclockwise (zero position)
TEST VOLTAGE switch	1.5 kV
TIMER switch	OFF position
LOWER switch	OFF position
MULTIPLIER knob	CAL'D position
CUTOFF CURRENT knob	0.5 mA

(2) Confirm that the DIP switch (S102) on the board A1 is set the Fig. 3-3.

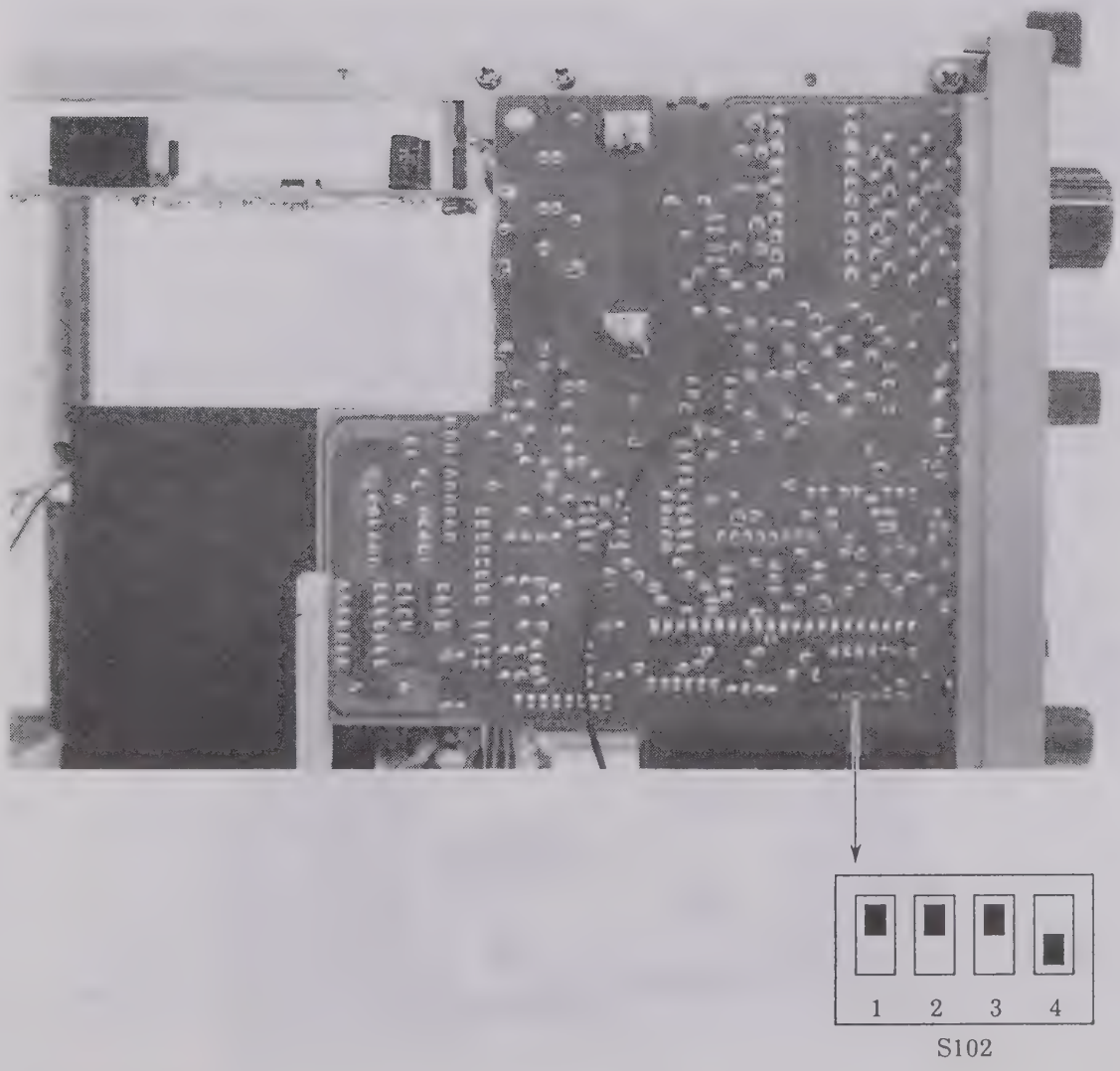

Fig. 3-3

Precautions before starting calibration and adjustment

TOS8650 can generate 5kV AC. Extreme caution should be taken to avoid accidents that could cause death or serious injury.

Note

Insure that the TOS8650 has been on for thirty minutes or longer after the power is turned on.

3.5.1 Mechanical zero adjustment of the voltmeter

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."
  Adjust the zero adjustment trimmer so that the index points zero after short-circuiting the meter. Refer to Fig.3-4.

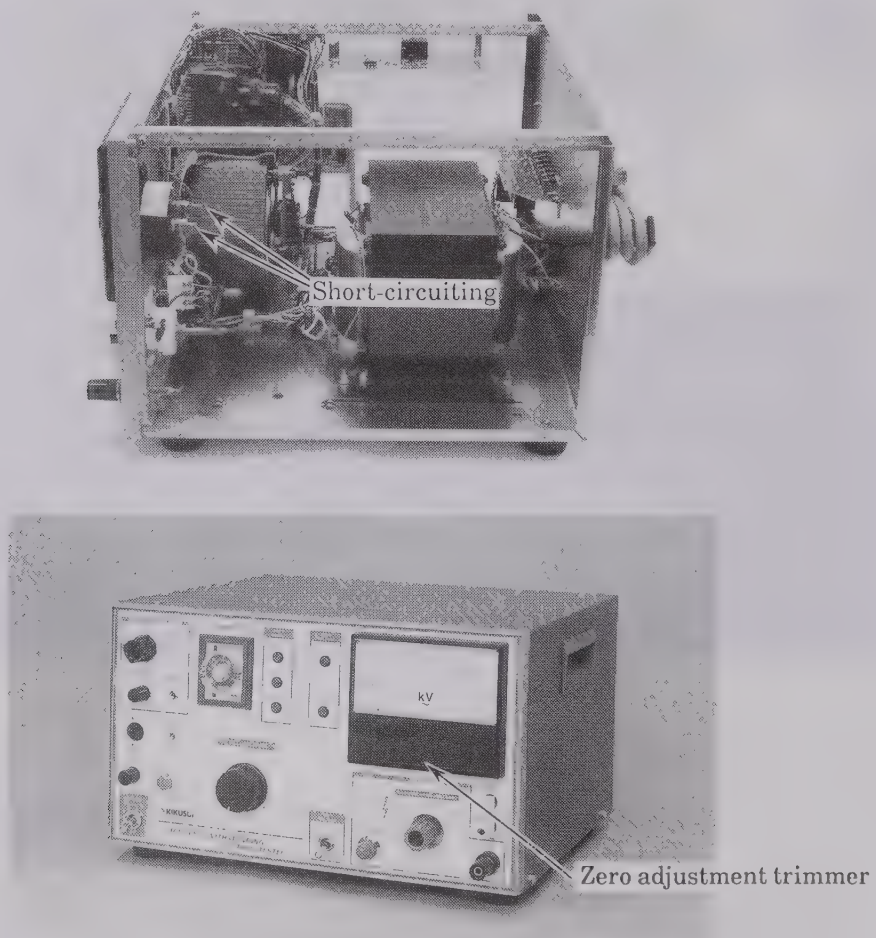

Fig. 3-4

3.5.2 Confirmation of supply voltages

Confirm that the supply voltages are in the following range with a digital voltmeter. Refer to Fig.3-5.

Table 3-3

Supply voltage	Board No.	Test point	Voltage range
+24 V	A1	TP100(GND), point A	+23 V to +30 V
+15 V	A1	TP100(GND), point B	+14.5 V to +15.1 V

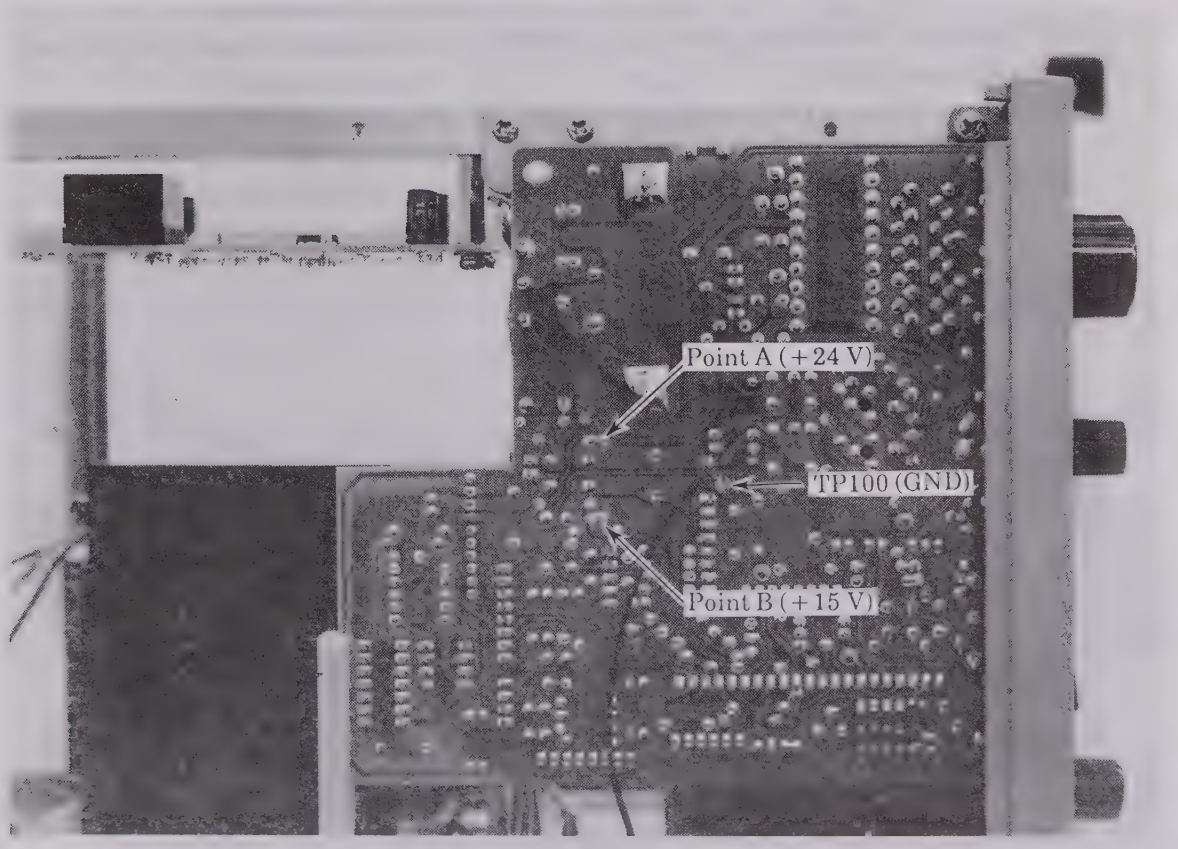

Fig. 3-5

3.5.3 Adjustment of the voltmeter

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."

(1) Connect the high voltage digital voltmeter to the output of the TOS8650.
(2) Turn on the **POWER** switch of the TOS8650.
(3) Press the **TEST** button of the TOS8650.
(4) Adjust the output with the **TEST VOLTAGE** knob so that the high voltage digital voltmeter indicates 1.500 kV.
(5) Adjust RV105 on the board A1 so that the index of the voltmeter points to the end of the 1.5 kV scale. Refer to Fig. 3-6.
(6) After adjusting the output voltage to 0, set the **TEST VOLTAGE** switch to **5 kV**.
(7) Adjust the **TEST VOLTAGE** knob of the TOS8650 so that the high voltage digital voltmeter indicates 5.000 kV.
(8) Adjust RV106 on the board A1 so that the index of the voltmeter points to the end of the 5kV scale. Refer to Fig. 3-6.
(9) Sequentially set the output of the TOS8650 to 1 k, 2 k, 3 k and 4 kV and confirm that the error is within ±1.5 %.

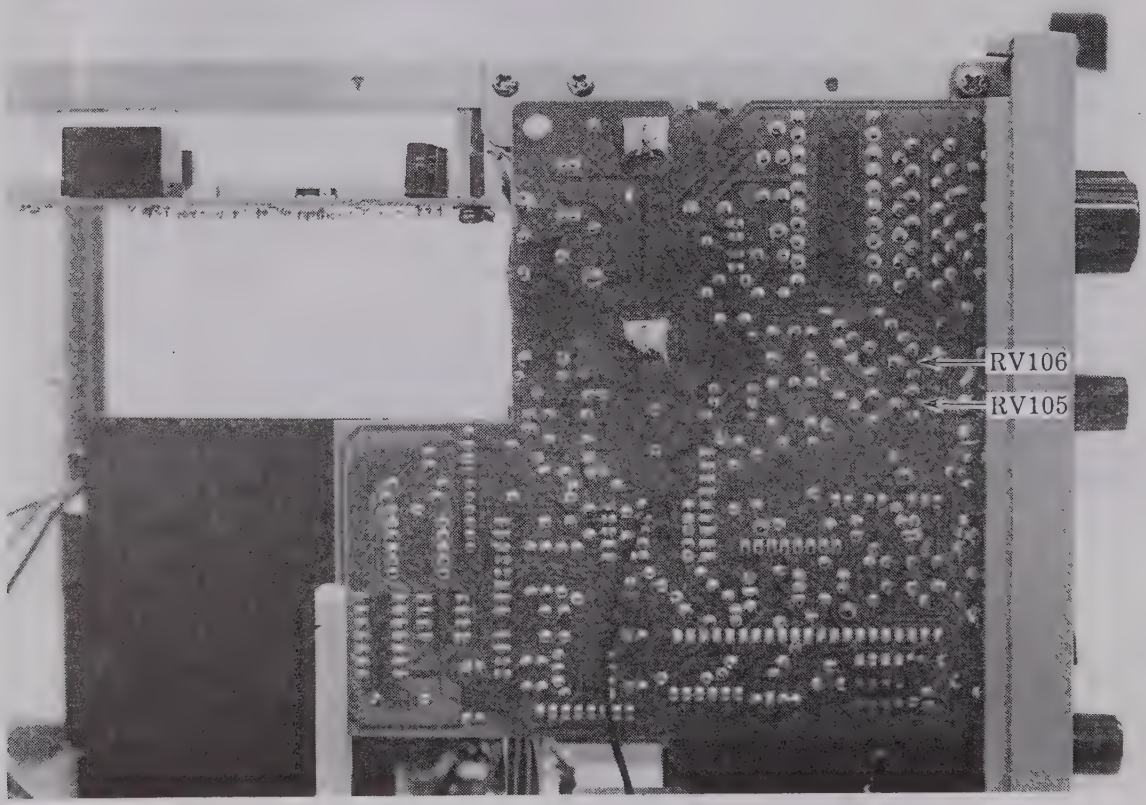

Fig. 3-6

3.5.4 Adjustment of the cutoff current

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."

(1) Connect the digital voltmeter between test pin TP100(GND) and TP106 on the board A1. Refer to Fig. 3-7.
(2) Turn on the **POWER** switch of the TOS8650.
(3) Adjust RV104 on the board A1 so that the value of the digital voltmeter reaches exactly 2.50 V. Refer to Fig. 3-7.
(4) Press the **RESET H.V OFF** button of the TOS8650.
(5) Connect the TOS1200 to the output of the TOS8650.
(6) Set the TOS1200 as follows.

AC/DC switch ..... **AC**
×1/×0.8 switch ..... **×1**
CUTOFF CURRENT ..... **0.5 mA**

(7) Press the **TEST** button of the TOS8650.
(8) Increase the output voltage until the NG alarm is actuated. (approximately 1 kV)
(9) Stop turning the **TEST VOLTAGE** knob when you hear the NG alarm.
(10) Decrease the **TEST VOLTAGE** knob a little to the left.
(11) Output the test voltage again with the **TEST** button and turn the **TEST VOLTAGE** knob very gradually to increase the voltage.
(12) Read the meter of the TOS1200 immediately before reaching output trip point.
(13) Adjust RV104 on the board A1 so that the **NG** alarm occurs when the meter of the TOS1200 indicates exactly 1.0. Refer to Fig. 3-7.

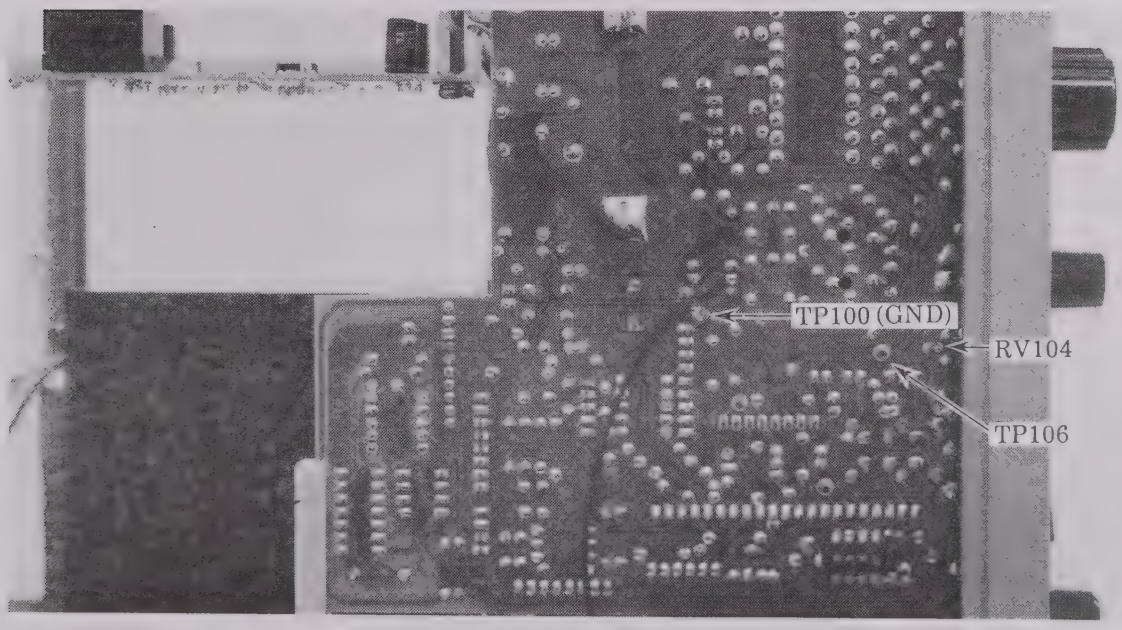

Fig. 3-7

3.5.5 Adjustment of the GOOD signal output

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."

(1) Connect TP100(GND) and TP102 to the oscilloscope with a probe(10:1). Refer to Fig. 3-8.

(2) Set the oscilloscope as follows.

TIME/DIV ..... 50 mS
VOLTS/DIV ..... 1 V
SLOPE ..... negative(-)
SWEEPMODE ..... NORM

(3) Set the TIMER of the TOS8650 to ON position and to 2 sec or more.

(4) Turn on the POWER switch of the TOS8650.

(5) Press the TEST button of the TOS8650.

(6) Observe the waveform when the GOOD signal is output.
If you do not see the waveform, adjust TRIGGER LEVEL of the oscilloscope to catch the waveform.

(7) Adjust RV102 on board A1 so that the length of signal becomes 200 ms. Refer to Fig.3-8 and Fig. 3-9.

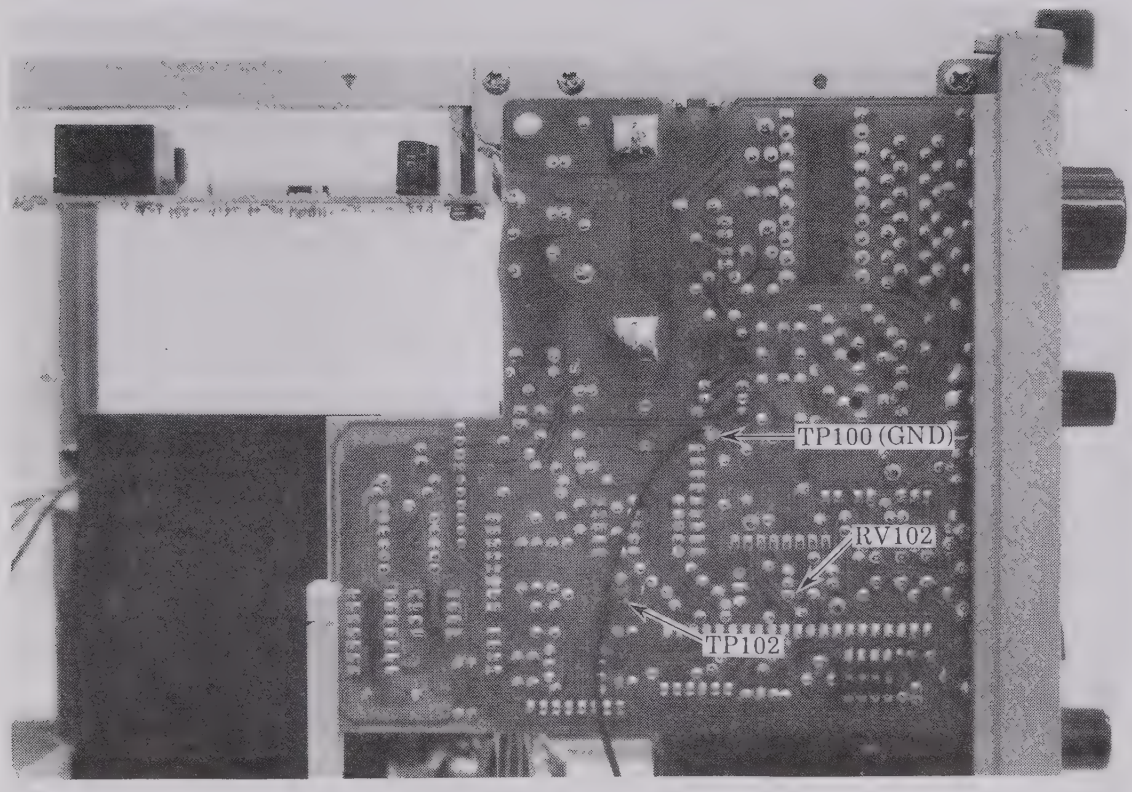

Fig. 3-8

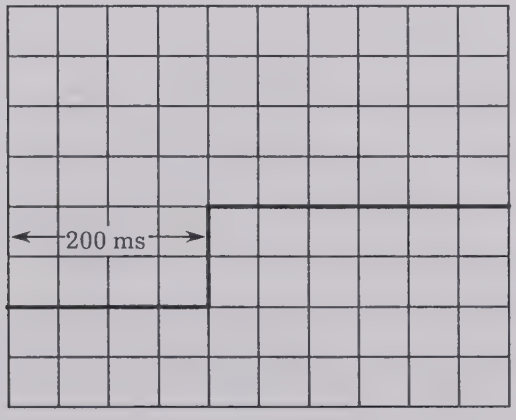

Fig. 3-9

3.5.6 Time adjustment of double action

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."

(1) Set the DIP switch(S102) on the A1 board as the Fig. 3-10.

(2) Connect TP100(GND) and TP103 to CH1 of the oscilloscope with a probe(10:1). Refer to Fig. 3-10.

(3) Connect TP100(GND) and TP101 to CH2 of the oscilloscope with a second probe(10:1). Refer to Fig. 3-10.

(4) Set the oscilloscope as follows.

TIME/DIV	0.1 sec
CH1, 2 VOLTS/DIV	1 V
TRIGGER	CH1
SWEEP MODE	NORM
SLOPE	positive (+)
VERT MODE	DUAL

(5) Turn on the POWER switch of the TOS8650.

(6) Press the TEST button and the RESET H.V OFF button simultaneously (Hold both buttons more than 1 sec.). Release the RESET H.V OFF button.

(7) Adjust RV101 on board A1 so that the length of the signal becomes 0.55 sec. Refer to Fig.3-10 and Fig. 3-11.
If you do not see the waveform, adjust the TRIGGER LEVEL of the oscilloscope to catch the waveform.

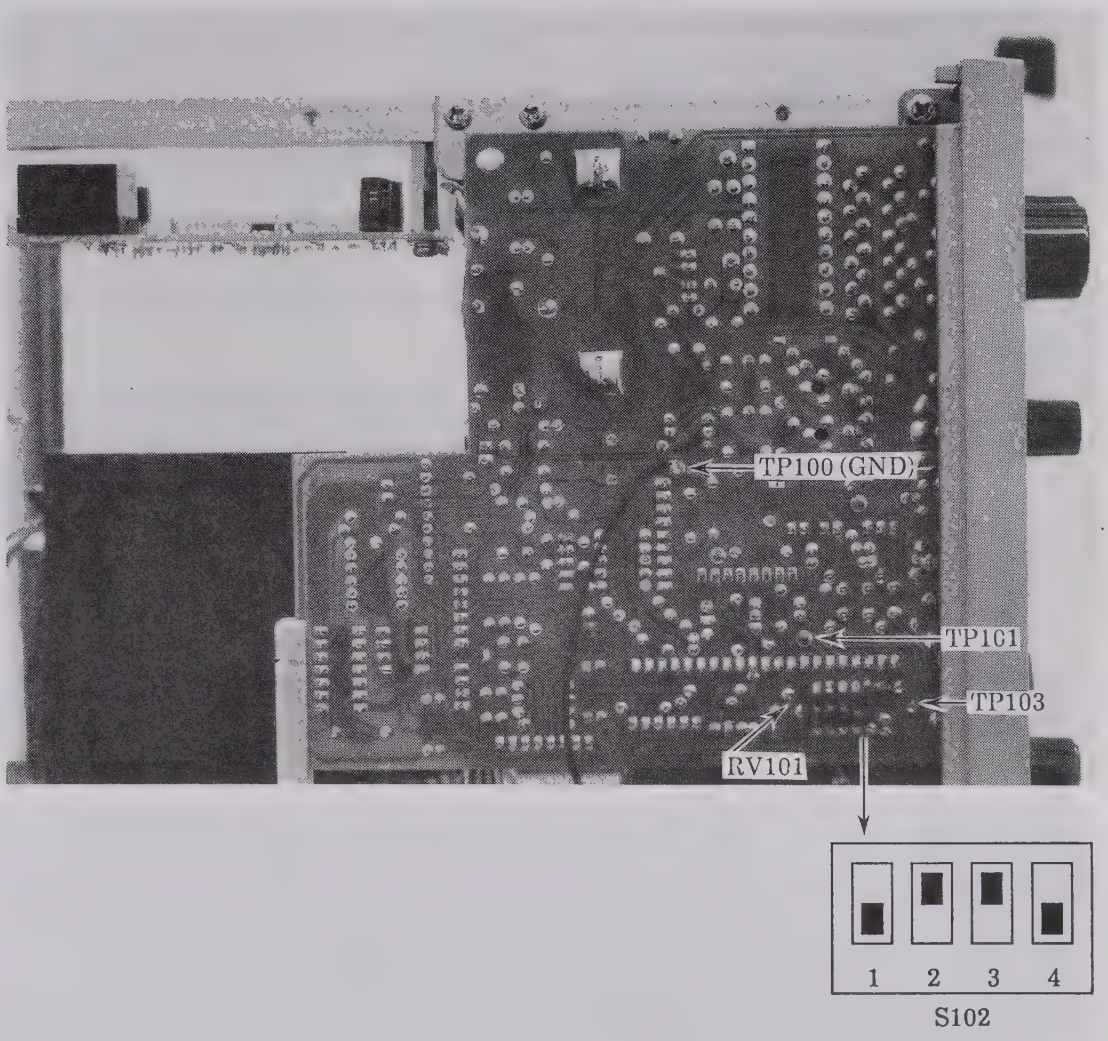

Fig. 3-10

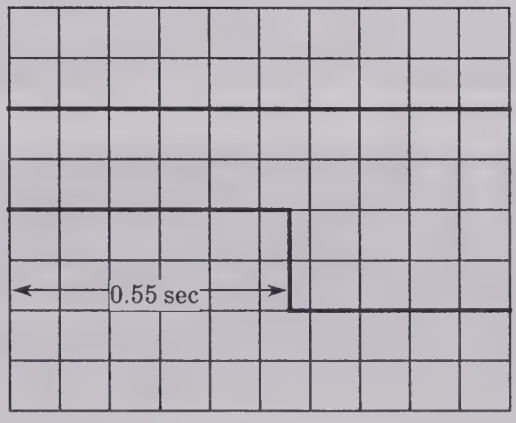

Fig. 3-11

3.5.7 Check the fail safe function of the power supply

- Perform the following procedure from the initial setting condition. Refer to "3.4 Initial setting."

(1) Connect the test lead to TP100(GND) of the A1 board with a jumper wire. Refer to Fig. 3-12.
(2) Turn on the POWER switch of the TOS8650.
(3) Press the TEST button of the TOS8650.
(4) Confirm that the TEST lamp goes off when the jumper wire is connected to the pin #5 of U2 on the A8650 board. Refer to Fig. 3-13.

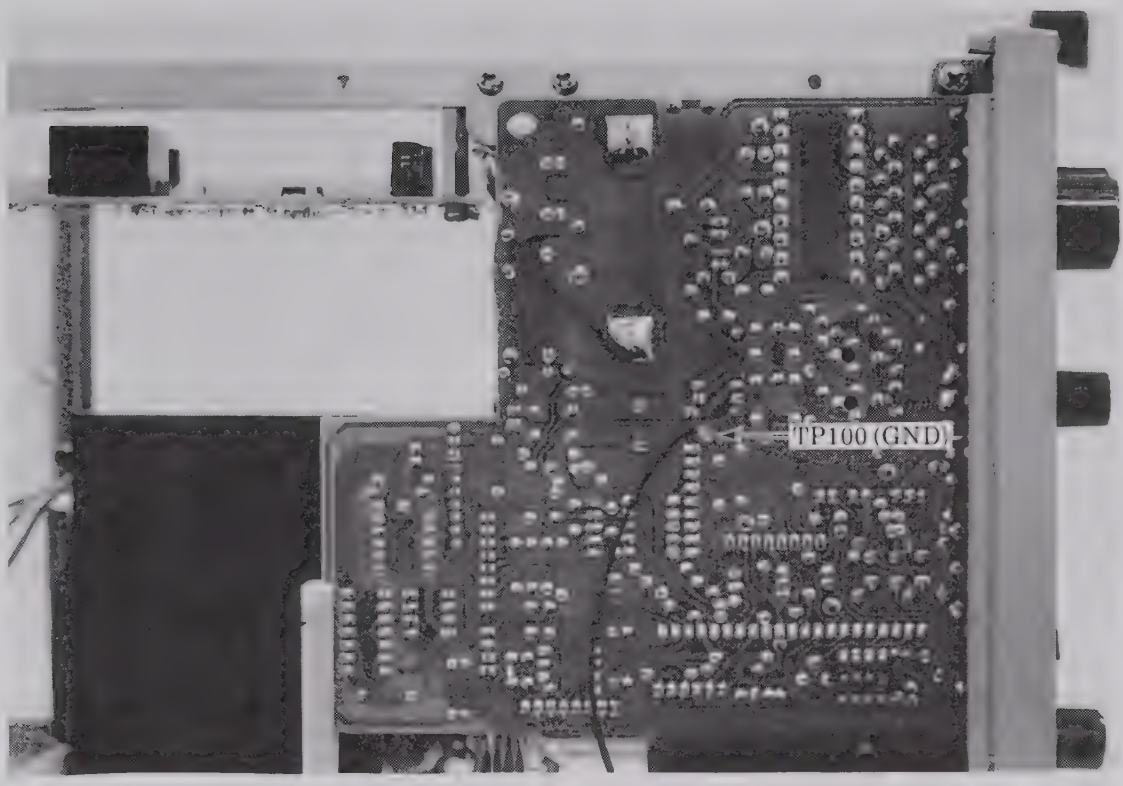

Fig. 3-12

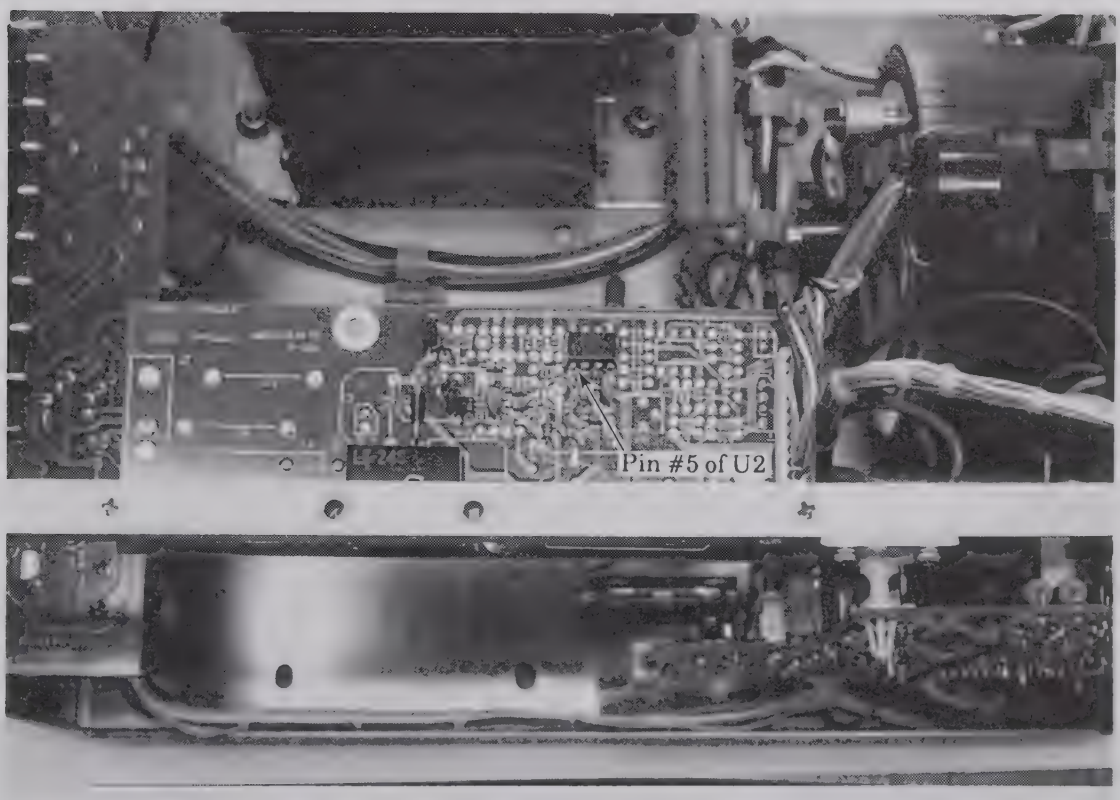

Fig. 3-13

SECTION 4

PARTS LOCATION

4. PARTS LOCATION

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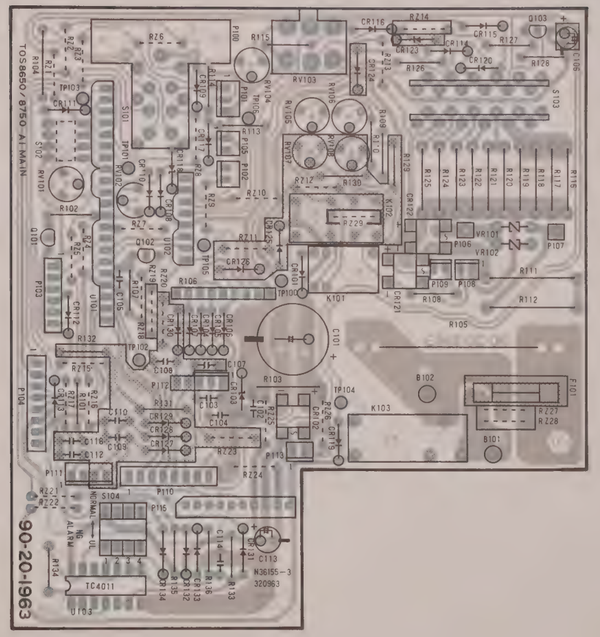
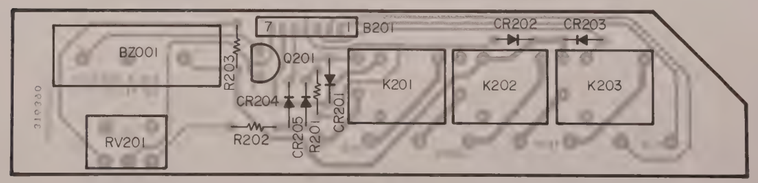
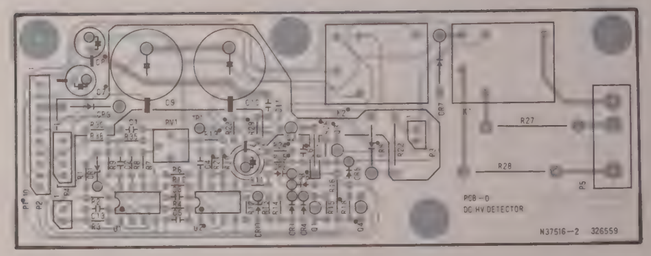


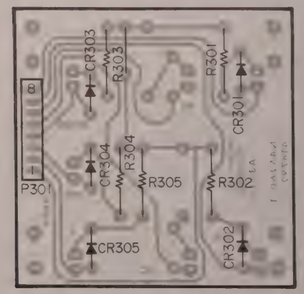
A1 MAIN BOARD (N36155-3)



A2 SIGNAL OUTPUT BOARD (N35290-1)



A8650 AC HV DETECTOR BOARD (N37516-2)



A3 DISPLAY BOARD (N45260-1)

SECTION 5

CIRCUIT DIAGRAMS

5. CIRCUIT DAIAGRAMS

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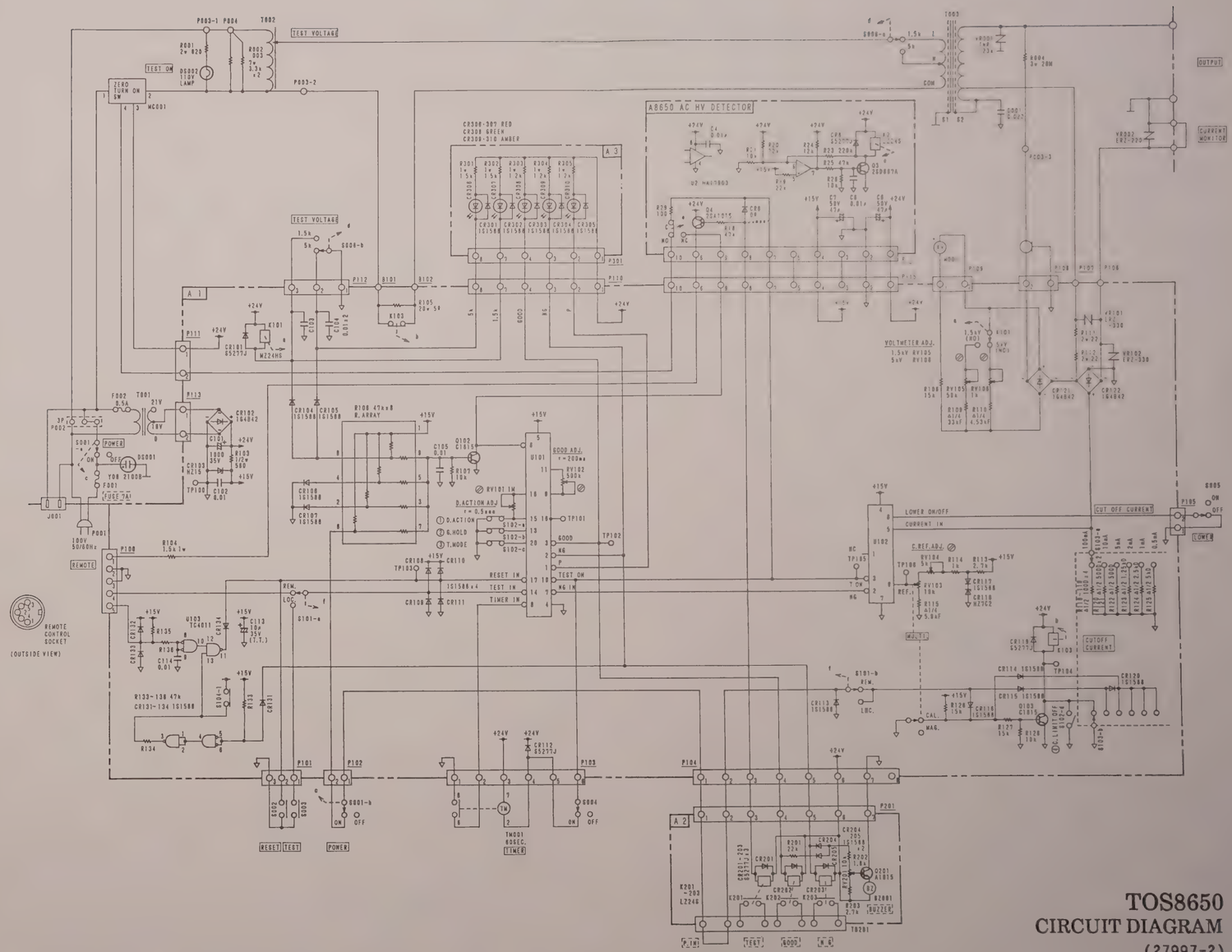
NOTE

Parts	Omitted units	Omitted functions
Resistors	Ω	All resistors are given in ohems, 1/4W, 5%, carbon film,unless oterwise indicated.
Capacitors	μF	The type, accuracy, and rated voltage of capacitors are all different. For details, refer to the parts list.

Table 5-1 Omitted units and functions

Symbols	Meanings
△	Metal film resistors
⊘	Semi-fixed resistros

Table 5-2 Special symbols and their meanings



TOS8650
CIRCUIT DIAGRAM
(27997-2)

SECTION 6

PARTS LIST

6. PARTS LIST

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Abbreviation

Abbreviation	Description
A-COM	Anode Common
A/D	Analog to Digital
ANLG	Analog
ASSY	Assembly
ATTEN	Attenuator
BCD	Binary Coded Decimal
BFR	Buffer
BRDG	Bridge
BUZ	Buzzer
C CMPSN	Carbon Composition
C FLM	Carbon Film
C-COM	Cathode Common
C-NTWK	Capacitor Network
CB	Circuit Breaker
CER	Ceramic
CH	Channel
CHAR	Charactor
CHC	Chocke Coil
CKT	Circuit
CNTR	Counter
COM	Common
COMPTR	Comparator
CONN	Connector
CONT	Controller
CONV	Converter
CPU	Central Processing Unit
CRT	Cathode-Ray Tube
CTC	Counter Timer Circuit
DESIG	Designator
DIA	Diameter
DIO	Diode
DIP	Dual Inline Package
DSPL	Display
EEPROM	Electrically Erasable PROM
ELCTLT	Electrolytic
EMI	Electromagnetic Interference

Abbreviation	Description
ENV	Envelope
FET	Field Effect Transistor
FF	Flip-Flop
FXD	Fixed
GEN	Generator
GP-IB	General Purpose Interface Bus
HF	High Frequency
HIC	Hybrid Integrated Circuit
HORIZ	Horizontal
HV	High Voltage
IC	Integrated Circuit
ICU	Interrupt Control Unit
INV	Inverter
KYBD	Keyboard
L-IMPD	Low Impedance
LED	Light Emitting Diode
M FLM	Metal Film
M GLZ	Metal Glaze
M OXD	Metal Oxide
MFR	Manufacturer
OP-AMP	Operational Amplifier
PCB	Printed Circuit Board
PLSTC FLM	Plastic Film
POS	Positive
POSN	Position
POT	Potentiometer
PRL	Parallel
PROM	Programmable ROM
PUT	Programable Unijunction Transistor
PWR	Power
R-FUSE	Resistor Fuse
R-NTWK	Resistor Network
RCPT	Receptacle
REF	Reference
RES	Resistor
RGLTR	Regulator
RLY	Relay
SB	Slow Blow
SEG	Segment

Abbreviation	Description
SEL	Selector
SHF	Shift
SI	Silicon
SIP	Single Inline Package
SOL	Solid
SRAM	Static RAM
SW	Switch
SYN	Synchronous
TA ELCTLT	Tantalum Electrolytic
THYR	Thyristor
TPL	Tripl
TRIG	Trigger
VAR	Variable
VERT	Vertical
W-ASSY	Wire Assembly
WW	Wire Wound
XFMR	Transeformer
XSTR	Transistor
XTAL	Crystal

Abbreviation	Manufacturer
AD	Analog Devices Inc.
AMD	Advanced Micro Devices Inc.
BB	Burr Brown Corp.
FUJI-ELE.	Fuji Electric Co., Ltd
JRC	Japan Redio Co., Ltd.
LTC	Linear Technology Corp.
MATSUSHI.	Matsushita Electric Industory Co., Ltd.
MITSUBIS.	Mitsubishi Electric Corp.
N.INTER	Nihon Inter Electronics Corp.
NNK	Nihon Kaiheiki Industry Co.,Ltd.
NS	National Semiconductor Corp.
PMI	Precision Monolithics Inc.
SHINDENG.	Shindengen Electric Co., Ltd.
TI	Texas Instrument Inc.

ASSY.NO. PA-1804-01 A1 MAIN BOARD ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
	90-20-1963	BLANK PCB A1		
C101	54-00-0231	FXD ELCTLT 1000 μF 35V		SM35VB
C102	50-67-0030	FXD PLSTC FLM 0.01 μF 100V		CQ92MC
C103	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C104	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C105	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C106	NC-000-000	------- NOT CONNECTED -------		
C107	NC-000-000	------- NOT CONNECTED -------		
C108	NC-000-000	------- NOT CONNECTED -------		
C109	NC-000-000	------- NOT CONNECTED -------		
C110	NC-000-000	------- NOT CONNECTED -------		
C112	NC-000-000	------- NOT CONNECTED -------		
C113	55-37-2100	FXD TA ELCTLT 10 μF 35V		CS15E1V
C114	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C116	NC-000-000	------- NOT CONNECTED -------		
CR101	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR102	32-90-2110	DIO BRDG 400V 1A	TOSHIBA	1G4B42
CR103	32-93-0151	DIO ZENER 14.5-15.1V 0.4W	HITACHI	HZ15-2L
CR104	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR105	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR106	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR107	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR108	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR109	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR110	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR111	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR112	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR113	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR114	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR115	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR116	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR117	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR118	32-93-0077	DIO ZENER 7.3-7.7V 0.5W	HITACHI	HZ7C2L
CR119	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR120	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR121	32-90-2110	DIO BRDG 400V 1A	TOSHIBA	1G4B42
CR122	32-90-2110	DIO BRDG 400V 1A	TOSHIBA	1G4B42
CR123	NC-000-000	------- NOT CONNECTED -------		
CR124	NC-000-000	------- NOT CONNECTED -------		
CR125	NC-000-000	------- NOT CONNECTED -------		
CR126	NC-000-000	------- NOT CONNECTED -------		
CR127	NC-000-000	------- NOT CONNECTED -------		
CR128	NC-000-000	------- NOT CONNECTED -------		
CR129	NC-000-000	------- NOT CONNECTED -------		
CR130	NC-000-000	------- NOT CONNECTED -------		
CR131	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR132	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR133	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR134	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
F101	NC-000-000	------- NOT CONNECTED -------		
K101	71-07-0180	RELAY DC 24V		MZ24HS
K102	NC-000-000	------- NOT CONNECTED -------		
K103	71-09-0130	RELAY DC 24V		VS-24STBN
P100	83-10-5050	CONN 5P DIN FEMALE TOP-TYPE		D5-727A-01
P101	84-80-0271	CONN 3P MALE TOP-TYPE		5045-03A
P102	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P103	84-80-0254	CONN P FLAT WAFER		3022-06A 2.5-06
P104	84-80-0255	CONN P FLAT WAFER		3022-08A 2.5-08
P105	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P106	87-40-0040	CONN PIN		RT-08T-1.3B
P107	87-40-0040	CONN PIN		RT-08T-1.3B
P108	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P109	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P110	84-80-0255	CONN P FLAT WAFER		3022-08A 2.5-08
P111	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P112	84-80-0271	CONN 3P MALE TOP-TYPE		5045-03A
P113	84-80-0270	CONN 2P MALE TOP-TYPE		5045-02A
P115	84-89-0460	CONN 10P MALE TOP-TYPE		5267-10A
Q101	NC-000-000	------- NOT CONNECTED -------		
Q102	30-31-8151	XSTR SI N 50V 0.15A 0.4W	TOSHIBA	2SC1815-Y
Q103	30-31-8151	XSTR SI N 50V 0.15A 0.4W	TOSHIBA	2SC1815-Y
R102	NC-000-000	------- NOT CONNECTED -------		
R103	40-37-1561	FXD C FLM 560 ohm 5% 1/2W		RD1/2PXJ
R104	44-91-2150	FXD M OXD 1.5k ohm 5% 1W		MOR1B
R105	43-87-0241	FXD WW 5 ohm 20W		RWH20G
R106	44-07-0140	R-NTWK 47k ohm X8		TNB09F473J
R107	40-27-3102	FXD C FLM 10k ohm 5% 1/4W		NAS1/4S
R108	40-27-3152	FXD C FLM 15k ohm 5% 1/4W		NAS1/4S
R109	42-72-3330	FXD M FLM 33k ohm 1% 1/4W		CM1/4
R110	42-72-2453	FXD M FLM 4.53k ohm 1% 1/4W		CM1/4
R111	44-92-0220	FXD M OXD 22 ohm 5% 2W		MOF-2B
R112	44-92-0220	FXD M OXD 22 ohm 5% 2W		MOF-2B
R113	40-27-2272	FXD C FLM 2.7k ohm 5% 1/4W		NAS1/4S
R114	40-27-2102	FXD C FLM 1k ohm 5% 1/4W		NAS1/4S
R115	42-72-2590	FXD M FLM 5.9k ohm 1% 1/4W		CM1/4
R116	42-73-1100	FXD M FLM 100 ohm .5% 1/2W		CM1/2
R117	42-73-1100	FXD M FLM 100 ohm .5% 1/2W		CM1/2
R118	42-73-1100	FXD M FLM 100 ohm .5% 1/2W		CM1/2
R119	42-73-1100	FXD M FLM 100 ohm .5% 1/2W		CM1/2
R120	42-73-1500	FXD M FLM 500 ohm .5% 1/2W		CM1/2
R121	42-73-1500	FXD M FLM 500 ohm .5% 1/2W		CM1/2
R122	42-73-1500	FXD M FLM 500 ohm .5% 1/2W		CM1/2
R123	42-73-2125	FXD M FLM 1.25k ohm .5% 1/2W		CM1/2
R124	42-73-2250	FXD M FLM 2.5k ohm .5% 1/2W		CM1/2
R125	42-73-2500	FXD M FLM 5k ohm .5% 1/2W		CM1/2

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
R126	40-27-3152	FXD C FLM 15k ohm 5% 1/4W		NAS1/4S
R127	40-27-3152	FXD C FLM 15k ohm 5% 1/4W		NAS1/4S
R128	40-27-3102	FXD C FLM 10k ohm 5% 1/4W		NAS1/4S
R129	NC-000-000	------- NOT CONNECTED -------		
R130	NC-000-000	------- NOT CONNECTED -------		
R131	NC-000-000	------- NOT CONNECTED -------		
R132	NC-000-000	------- NOT CONNECTED -------		
R133	40-27-3472	FXD C FLM 47k ohm 5% 1/4W		NAS1/4S
R134	40-27-3472	FXD C FLM 47k ohm 5% 1/4W		NAS1/4S
R135	40-27-3472	FXD C FLM 47k ohm 5% 1/4W		NAS1/4S
R136	40-27-3472	FXD C FLM 47k ohm 5% 1/4W		NAS1/4S
RV101	48-33-5100	VAR M GLZ 1M ohm B		TM64K3(PV)
RV102	48-33-4500	VAR M GLZ 500k ohm B		TM64K3(PV)
RV103	46-16-3101	VAR M GLZ 10k ohm		RG161P
RV104	48-33-2500	VAR M GLZ 5k ohm B		TM64K3(PV)
RV105	48-33-3500	VAR M GLZ 50k ohm B		TM64K3(PV)
RV106	48-33-2100	VAR M GLZ 1k ohm B		TM64K3(PV)
RV107	NC-000-000	------- NOT CONNECTED -------		
RV108	NC-000-000	------- NOT CONNECTED -------		
RZ101	40-27-0000	JUMPER PART		NAS1/4
RZ102	40-27-0000	JUMPER PART		NAS1/4
RZ103	40-27-0000	JUMPER PART		NAS1/4
RZ104	40-27-0000	JUMPER PART		NAS1/4
RZ105	40-27-0000	JUMPER PART		NAS1/4
RZ106	40-27-0000	JUMPER PART		NAS1/4
RZ107	40-27-0000	JUMPER PART		NAS1/4
RZ108	40-27-0000	JUMPER PART		NAS1/4
RZ109	40-27-0000	JUMPER PART		NAS1/4
RZ110	40-27-0000	JUMPER PART		NAS1/4
RZ111	NC-000-000	------- NOT CONNECTED -------		
RZ112	40-27-0000	JUMPER PART		NAS1/4
RZ113	40-27-0000	JUMPER PART		NAS1/4
RZ114	40-27-0000	JUMPER PART		NAS1/4
RZ115	40-27-0000	JUMPER PART		NAS1/4
RZ116	40-27-0000	JUMPER PART		NAS1/4
RZ117	40-27-0000	JUMPER PART		NAS1/4
RZ118	40-27-0000	JUMPER PART		NAS1/4
RZ119	40-27-0000	JUMPER PART		NAS1/4
RZ120	NC-000-000	------- NOT CONNECTED -------		
RZ121	40-27-0000	JUMPER PART		NAS1/4
RZ122	40-27-0000	JUMPER PART		NAS1/4
RZ123	NC-000-000	------- NOT CONNECTED -------		
RZ124	40-27-0000	JUMPER PART		NAS1/4
RZ125	40-27-0000	JUMPER PART		NAS1/4
RZ126	40-27-0000	JUMPER PART		NAS1/4
RZ127	40-27-0000	JUMPER PART		NAS1/4
RZ128	40-27-0000	JUMPER PART		NAS1/4
RZ129	40-27-0000	JUMPER PART		NAS1/4

ASSY.NO. PA-1804-01 A1 MAIN BOARD ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
S101	81-01-0320	SW PUSH		DW-721D-00
S102	82-95-0010	SW DIP		SSGM14036A
S103	80-98-0680	SW ROTARY		SR26(PH-4)N
S104	82-95-0010	SW DIP		SSGM14036A
TP100	87-40-0070	TEST PIN		
TP101	87-40-0070	TEST PIN		
TP102	87-40-0070	TEST PIN		
TP103	87-40-0070	TEST PIN		
TP104	87-40-0070	TEST PIN		
TP105	87-40-0070	TEST PIN		
TP106	87-40-0070	TEST PIN		
U101	35-99-0010	HIC (CSEQUENEC)	KIKUSUI	
U102	35-99-0020	HIC (CURRENT DETECTOR)	KIKUSUI	
U103	35-60-0000	QUAD 2-INPUT NAND GATES	TOSHIBA	TC4011BP
VR101	39-00-0250	SURGE ABSORBER 330V	MATSUSHI.	ERZ-C10DK
VR102	39-00-0250	SURGE ABSORBER 330V	MATSUSHI.	ERZ-C10DK

ASSY.NO. PA-1800-01 A2 SIGNAL OUTPUT BOARD ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
	90-20-1980	BLANK PCB A2		
BZ001	95-00-0130	BUZZER		PKB7-3A0
CR201	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR202	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR203	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
CR204	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR205	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
K201	71-07-0171	RELAY DC 24V		LZ 24S,
K202	71-07-0171	RELAY DC 24V		LZ 24S,
K203	71-07-0171	RELAY DC 24V		LZ 24S,
P201	84-89-0445	CONN P STRAT.WAFER 2.5-7		5267-07A 2.5-07
Q201	30-11-0151	XSTR SI P 50V 0.15A 0.4W	TOSHIBA	2SA1015-Y
R201	40-27-3222	FXD C FLM 22k ohm 5% 1/4W		NAS1/4S
R202	40-27-2182	FXD C FLM 1.8k ohm 5% 1/4W		NAS1/4S
R203	40-27-2272	FXD C FLM 2.7k ohm 5% 1/4W		NAS1/4S
RV201	45-35-3101	VER C CMPSN 10k ohm		V16L4S
TB201	86-37-0011	TERMINAL BOARD 8P		S-108-8P

ASSY.NO. PA-1805-01 A3 DISPLAY BOARD ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
	90-20-1990	BLANK PCB A3		
	84-80-0200	CONN 2P MALE TOP-TYPE		5287-2A
	84-80-0200	CONN 2P MALE TOP-TYPE		5287-2A
	84-80-0200	CONN 2P MALE TOP-TYPE		5287-2A
	84-80-0200	CONN 2P MALE TOP-TYPE		5287-2A
CR301	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR302	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR303	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR304	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR305	32-11-5880	DIO SI 30V 0.12A	TOSHIBA	1S1588
CR306	37-00-0130	LED RED	POHM	RLD7-23PDS
CR307	37-00-0130	LED RED	POHM	RLD7-23PDS
CR308	37-00-0170	LED GREEN	ROHM	RLD7-537PDS
CR309	37-00-0160	LED AMBER	ROHM	RLD7-337ADS
CR310	37-00-0160	LED AMBER	ROHM	RLD7-337ADS
P301	84-89-0550	CONN 8P MALE SIDE-TYPE		5268-08A 2.5-08
R301	44-91-2150	FXD M OXD 1.5k ohm 5% 1W		MOR1B
R302	44-91-2150	FXD M OXD 1.5k ohm 5% 1W		MOR1B
R303	44-91-2120	FXD M OXD 1.2k ohm 5% 1W		MOR1B
R304	44-91-2120	FXD M OXD 1.2k ohm 5% 1W		MOR1B
R305	44-91-2120	FXD M OXD 1.2k ohm 5% 1W		MOR1B

ASSY.NO. PA-0970-01 A8650 AC HV DETECTOR BOARD ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
C4	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C6	52-05-2468	FXD CER 0.01 μF +80-20% 50V		ECK-F1H
C7	54-00-1314	FXD ELCTLT 47 μF 50V		KME50VB
C8	54-00-1314	FXD ELCTLT 47 μF 50V		KME50VB
CR6	40-16-0001	JUMPER PART		RD1/6ZFS
CR8	32-90-0523	DIO 600V 1A	TOSHIBA	S5277J
K2	71-07-0171	RELAY DC 24V		LZ 24S,
P1	84-89-0460	CONN 10P MALE TOP-TYPE		5267-10A
PCB1	90-20-2750	BLANK PCB HV DET		
Q3	30-40-6671	XSTR SI N 120V 1A 0.9W	HITACHI	2SD667A-C
Q4	30-11-0151	XSTR SI P 50V 0.15A 0.4W	TOSHIBA	2SA1015-Y
R18	40-16-3471	FXD C FLM 47k ohm 5% 1/6W		RD1/6FS
R19	40-16-3221	FXD C FLM 22k ohm 5% 1/6W		RD1/6FS
R20	40-16-3221	FXD C FLM 22k ohm 5% 1/6W		RD1/6FS
R21	40-16-3101	FXD C FLM 10k ohm 5% 1/6W		RD1/6FS
R23	40-16-4221	FXD C FLM 220k ohm 5% 1/6W		RD1/6FS
R24	40-16-3121	FXD C FLM 12k ohm 5% 1/6W		RD1/6FS
R25	40-16-3471	FXD C FLM 47k ohm 5% 1/6W		RD1/6FS
R26	40-16-3101	FXD C FLM 10k ohm 5% 1/6W		RD1/6FS
R29	40-16-1101	FXD C FLM 100 ohm 5% 1/6W		RD1/6FS
TP1	87-40-0090	TEST PIN		NO.246
U2	34-20-0130	DUAL COMPTR	HITACHI	HA17903PS

OTHER ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
	92-01-1020	TERMINAL RED		TMEV1.25-5
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	91-82-1043	W-ASSY TOS8650 PL		
	87-40-0060	CONN		SDF-01T-1.3AS
	84-51-0000	FUSE HOLDER		AF007
	92-01-1110	TERMINAL BLUE		TMEV2-4
	92-01-1110	TERMINAL BLUE		TMEV2-4
	84-89-0445	CONN P STRAT.WAFER 2.5-7		5267-07A 2.5-07
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	92-01-1010	TERMINAL		TMEV1.25-4
	87-40-0060	CONN		SDF-01T-1.3AS
	92-01-1010	TERMINAL		TMEV1.25-4
	91-82-1042	W-ASSY TOS8650		
	84-51-0060	FUSE HOLDER		X-N1157-01
	40-27-0000	JUMPER PART		NAS1/4
	92-01-1010	TERMINAL		TMEV1.25-4
	40-27-0000	JUMPER PART		NAS1/4
	92-01-1010	TERMINAL		TMEV1.25-4
	84-89-0550	CONN 8P MALE SIDE-TYPE		5268-08A 2.5-08
DS001	24-00-0040	ARRESTER		Y08-2100B
DS002	23-24-0000	LANP FIL 110V T-10 E-10		
F001	99-00-0111	FUSE 7A S.B		F-7161
F002	99-00-0103	FUSE 0.5A S.B		F-1065
J001	83-20-2000	RCPT AC		S-80
M001	70-03-0133	METER 5/1.5KV/AC		2076
MC001	39-90-0030	ZERO CROSS SWITCH	N.INTER	D2W-5003
P001	85-10-0040	AC CORD 2.5 M		VFK-GRAY
P002	92-11-3000	TERMINAL STEATITE		
P003	92-11-3000	TERMINAL STEATITE		
P004	92-10-1020	TERMINAL		LI 1P 24L
R001	44-92-1820	FXD M OXD 820 ohm 5% 2W		MOR2B
R002	44-96-2330	FXD M OXD 3.3k ohm 5% 7W		MOF-7B
R003	44-96-2330	FXD M OXD 3.3k ohm 5% 7W		MOF-7B
R004	42-57-0030	FXD M CLAD 20M ohm 5% 3W		RH3HVS
S001	82-32-0280	SW TOGGLE		ET210N12
S002	82-11-0070	SW MICRO		V-15-1A5
S003	82-11-0090	SW MICRO		V-15-1A5

ASSY.NO. OTHER ASSY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
S004	82-31-0032	SW TOGGLE		AS550ABA12
S005	82-31-0032	SW TOGGLE		AS550ABA12
S006	82-32-0280	SW TOGGLE		ET210N12
T001	60-12-0240	PWR XFMR TOS8700		
T002	61-16-0011	SLIDE XFMR TOS8650/51/750		
T003	60-51-0101	PWR XFMR H.V TOS8650		
TM001	97-01-0090	TIMER DC24V 60SEC		CHP
VR001	39-00-0200	SURGE ABSORBER 12KV	MARUCON	TNR
VR002	39-00-0160	SURGE ABSORBER	MATSUSHI.	ERZ-C14DK

ACCESSORY

REF. DESIG.	KIKUSUI PART NO.	DESCRIPTION	MANU-FACTURER	MFR PART NO.
	89-01-0020	H.V TEST LEAD		HTL-1.5 W
	83-10-5060	CONN PLUG		E5-701B-00

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